**SYLLABUS OF SEMESTER SYSTEM**
**FOR THE TRADE OF**

# Mechanic Diesel

**Under**

**Craftsmen Training Scheme (CTS)**
**(One year/Two Semesters)**

**Redesigned in**
**2014**

By
**Government of India**
**Ministry of Labour & Employment (DGE&T)**

## GENERAL INFORMATION

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| 1. | Name of the Trade | : | **Mechanic Diesel** |
| 2. | N.C.O. Code No. | : | **7233.24** |
| 3. | Duration of Craftsmen Training | : | 1Year (Two Semester having duration of six months each) |
| 4. | Power Norms | : | 4.8 KW |
| 5. | Space Norms | : | Space Area 210 Sq. Mt. (Including parking area) |
| 6. | Entry Qualification | : | Passed 10th class examination with maths and Science. |
| 7. | Unit strength | : | 16 + 30% super Numeric |
| 8. | Instructors Qualification | : | a) Degree in Automobile/ Mechanical Engg. (with specialization in Automobile) from recognised college/University with one year experience in the automobile industry and should possess valid LMV driving license.<br>OR<br>Diploma in Automobile/Mechanical (specialization in automobile) from recognized board of technical education with two years experience in the automobile industry and should posses valid LMV driving license.<br>OR<br>10th Passed + NTC/NAC in the Trade of "**Mechanic Diesel"** with 3 years post qualification experience in the relevant field and should possess valid LMV driving license.<br>**and**<br>b) With "**National Crafts Instructor Certificate".** |

* **Note**:

1) At least one Instructor must have Degree/Diploma in Automobile/ Mechanical Engg. (with specialization in Automobile) when applied for 02 units.
2) Instructor Qualification for WCS & E.D, as per the Training Manual

9. For Employability Skills One Contract/Part Time/Guest Faculty for Generic Module .

i) MBA/ BBA with two years experience **OR** Graduate in Sociology / Social Welfare / Economics with Two years experience **OR** Graduate / Diploma with Two years experience and trained in Employability Skills from DGET institutes

AND

Must have studied English / Communication Skills and Basic Computer at $12^{th}$ / Diploma level and above

OR

Existing Social Study Instructors duly trained in Employability Skills from DGET institutes

**Distribution of training on Hourly basis:**

| Total hours /week | Trade practical | Trade theory | Work shop Cal. &Sc. | Engg. Drawing | Employability skills | Extracurricular activity |
|---|---|---|---|---|---|---|
| 42 Hours | 27 Hours | 5 Hours | 3 Hours | 3 Hours | 2 Hours | 2 Hours |

**COURSE INFORMATION (MECHANIC DIESEL)**

**1.Introduction :**

- An intensive industrial survey was made to ascertain the requirements of skill-gap in the automobile sector, a scientifically designed survey covering labour-market survey web-survey was conducted. Based on the data obtained the skills are identified and accordingly the syllabus has been drafted. Subsequently the Trade expert committed reviewed.

2. **Terminal Competencies/Deliverables :**

After successful completion of the above course, the trainee shall be able to perform the following skills with proper sequence.

- **Mechanic, Diesel Engine;** Oil Engine Fitter repairs services and overhauls diesel or oil engines for efficient performance as prime mover to drive machinery and equipment. Examines engine to locate defects, using various tools and instruments.
- Dismantles or partly dismantles it to remove damaged or worn out parts and replaces or repairs them.
- Replace valve and assembles parts, doing supplementary tooling and other functions as necessary to ensure accuracy of fit.
- Installs assembled or repaired engine in position and connects pulley or wheel to propulsion system. Starts engine, tunes it up and observes performance noting different meter readings. such as temperature, fuel level, oil pressure, etc. and sets it to specified standard for optimum performance.
- Checks, adjusts and lubricates engine periodically and performs such other functions to keep engine in good working order.
- May solder or braze parts and service diesel fuel pumps and injectors.
- Measures essential parts like cylinder, bores piston, sizes crank pins etc. using gauges, micrometer and other precision tools and gets cylinders re-bored, liners fitted, valve seats refaced, etc..

**3. Employment oppurtunities:**

On successful completion of the course the candidates can either get employed, or become a self-employed Entrepreneur in any one of the following fields.

| a) **Wage Employment** | **b) Self Employment** |
|---|---|
| 1. Auto Diesel engine Mechanic<br>2. Diesel Engine Service Technician<br>3. Auto Fitter in Manufacturing Concern in Assembly Shop or Test Shop<br>4. Mechanic in Auto Manufacturing Industry<br>5. Dealers service mechanic<br>6. Driver/Vehicle Operator<br>7. Spare Parts Sales Assistant / Manufacturers' Representative<br>8. Laboratory Assistant | 1. Automobile Mechanic<br>2.. Diesel Fuel System Service Mechanic<br>3. Vehicle Operator<br>4. Spare Parts Salesman<br>5. Spare Parts Dealer |

**4. Further learning pathways:**

- On successful completion of the course trainee can get themselves enrolled in Apprenticeship training in reputed Industrial organisation.
- The qualified candidates have scope for lateral entry into the Diploma courses offered by some of the State Governments
- The qualified candidates can also get themselves upgraded by taking up the Second Semester at his own convenience in the CTS scheme, since the first semester is common to the following trades.

Craftsman Training Scheme

1. Mechanic Motor Vehicle - 2 Years ( 4 Sem)
2. Mechanic Diesel – 1 Year ( 2 Sem)
3. Mechanic Motor Cycle - 1 Year ( 2 Sem)
4. Mechanic Auto Electrical and Electronics - 1 Year ( 2 Sem)
5. Mechanic Agricultural Machinery - 2 Years ( 4 Sem)
6. Mechanic Tractor - 1 Year ( 2 Sem)
7. Pump Operator cum Mechanic - 1 Year ( 2 Sem)

**Syllabus for the trade of Mechanic Diesel**
**First Semester (Semester code No. )**
**Duration: Six Months.**

**Syllabus for Trade practical and Trade Theory**

| Week No. | Trade Practical (27 Hrs/week) | Trade Theory (5 Hrs/week) |
|---|---|---|
| 1 | Familiarisation with institute, Job opportunities in the automobile sector, Machinery used in Trade. Types of work done by the students in the shop floor. | **Admission & introduction to the trade:** Introduction to the Course duration, course content, study of the syllabus. General rule pertaining to the Institute, facilities available– Hostel, Recreation, Medical and Library working hours and time table |
| 2 | Practical related to Safety and Health,<br>Importance of maintenance and cleanliness of Workshop.<br>Interaction with health centre and fire service station to provide demo on First aid and Fire safety, Use of fire extinguishers.<br>Demonstration on safe handling and Periodic testing of lifting equipment, and Safety disposal of Used engine oil.<br>Energy saving Tips of ITI electricity Usage | **Occupational Safety & Health**<br>Importance of Safety and general Precautions to be observed in the shop. Basic first aid, safety signs - for Danger, Warning, caution & personal safety message. Safe handling of Fuel Spillage, Fire extinguishers used for different types of fire. Safe disposal of toxic dust, safe handling and Periodic testing of lifting equipment, Authorization of Moving & road testing vehicles.<br>**Energy conservation**-Definition, Energy Conservation Opportunities (ECOs)-Minor ECos and Medium ECOs, Major ECOs), Safety disposal of Used engine oil, Electrical safety tips. |
| 3-5 | Practice using all marking aids, like steel rule with spring calipers, dividers, scriber, punches, Chisel etc.,<br>Layout a work piece- for line, circle, arcs and circles.<br>Practice to measure a wheel base of a vehicle with measuring tape.<br>Practice to measure valve spring tension using spring tension tester<br>Practice to remove wheel lug nuts with use of an air impact wrench<br>Practice on General workshop tools & power tools. | **Hand & Power Tools:-**<br>Marking scheme, **Marking material**-chalk, Prussian blue. Cleaning tools- Scraper, wire brush, Emery paper, Description, care and use of Surface plates, steel rule, measuring tape, try square. Calipers-inside and outside. Dividers, surface gauges, scriber, punches-**prick punch,** center punch, pin punch, hollow punch, number and letter punch. Chisel-flat, cross-cut. Hammer- ball pein, lump, mallet. Screw drivers-blade screwdriver, **Phillips** screw driver, Ratchet screwdriver. Allen key, bench vice & C-clamps, Spanners- ring spanner, open end spanner & the combination spanner, universal adjustable open end spanner. Sockets & accessories, Pliers - **Combination pliers, multi grip, long nose, flat-nose, Nippers** or pincer pliers, **Side cutters, Tin snips, Circlip pliers, external circlips pliers.** Air impact wrench, air ratchet, wrenches- Torque wrenches, pipe wrenches, car jet washers Pipe flaring & cutting tool, pullers-Gear and bearing. |

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| 6&7 | Measuring practice on Cam height, Camshaft Journal dia, crankshaft journal dia, Valve stem dia, piston diameter, and piston pin dia with outside Micrometers.<br>Measuring practice on the height of the rotor of an oil pump from the surface of the housing or any other auto component measurement with depth micrometer.<br>Measuring practice on valve spring free length.<br>Measuring practice on cylinder bore, Connecting rod bore, inside diameter (ID) of a camshaft bearing with Telescope gauges.<br>Measuring practice on cylinder bore for taper and out-of-round with Dial bore gauges.<br>Measuring practice to measure wear on crankshaft end play, crankshaft run out, and valve guide with dial indicator.<br>Measuring practice to check the flatness of the cylinder head is warped or twisted with straightedge is used with a feeler gauge.<br>Measuring practice to check the end gap of a piston ring, piston-to-cylinder wall clearance with feeler gauge.<br>Practice to check engine manifold vacuum with vacuum gauge.<br>Practice to check the air pressure inside the vehicle tires is maintained at the recommended setting. | **Systems of measurement**, Description, care & use of - Micrometers- Outside and depth mirometer, Micrometer adjustments, Vernier calipers, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge. |
| 8 & 9 | Practice on General cleaning, checking and use of nut, bolts, & studs etc.,<br><br>Removal of stud/bolt from blind hole.<br><br>Practice on cutting tools like Hacksaw, file, chisel, Sharpening of Chisels, center punch, safety precautions while grinding. | **Fasteners**- Study of different types of screws, nuts, studs & bolts, locking devices, Such as lock nuts, cotter, split pins, keys, circlips, lock rings, lock washers and locating where they are used. Washers & chemical compounds can be used to help secure these fasteners. Function of **Gaskets,** Selection of materials for gaskets and packing, **oil seals.**<br>**Cutting tools** :- Study of different type of cutting tools like Hacksaw, File- Definition, parts of a file, specification, Grade, shape, different type of |

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| | Practice on Hacksawing and filing to given dimensions. | cut and uses., OFF-hand grinding with sander, bench and pedestal grinders, safety precautions while grinding.<br>**Limits, Fits & Tolerances**:-Definition of limits, fits & tolerances with examples used in auto components |
| 10 & 11 | Practice on Marking and Drilling clear and Blind Holes, Sharpening of Twist Drills Safety precautions to be observed while using a drilling machine. Practice on Tapping a Clear and Blind Hole, Selection of tape drill Size, use of Lubrication, Use of stud extractor.<br>Cutting Threads on a Bolt/ Stud. Adjustment of two piece Die, Reaming a hole/ Bush to suit the given pin/ shaft, scraping a given machined surface. | **Drilling machine** - Description and study of Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Work Holding devices, Drill bits.<br>**Taps and Dies:** Hand Taps and wrenches, Calculation of Tap drill sizes for metric and inch taps. Different type of Die and Die stock. Screw extractors. **Hand Reamers** – Different Type of hand reamers, Drill size for reaming, Lapping, Lapping abrasives, type of Laps. |
| 12 | Practice on making Rectangular Tray.<br>Pipe bending, Fitting nipples unions in pipes. Soldering and Brazing of Pipes. | **Sheet metal** - State the various common metal Sheets used in Sheet Metal shop<br>Sheet metal operations - Shearing, bending, Drawing, Squeezing<br>Sheet metal joints - Hem & Seam Joints Fastening Methods - Riveting, soldering, Brazing. fluxes used on common joints. Sheet and wire-gauges. The blow lamp- its uses and pipe fittings. |
| 13 | Practice in joining wires using soldering Iron, Construction of simple electrical circuits, Measuring of current, voltage and resistance using digital multimeter, practice continuity test for fuses, jumper wires, fusible links, circuit breakers. | **Basic electricity**, Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, ammeter, Ohmmeter Mulitmeter, Conductors & insulators, Wires, Shielding, Length vs. resistance, Resistor ratings |
| 14 | Diagnose series, parallel, series-parallel circuits using Ohm's law, Check electrical circuit with a test lamp, perform voltage drop test in circuits using multimeter, measure current flow using multimeter /ammeter, use of service manual wiring diagram for troubleshooting. | Fuses & circuit breakers, Ballast resistor, Stripping wire insulation, cable colour codes and sizes, Resistors in Series circuits , Parallel circuits and Series-parallel circuits, Electrostatic effects, Capacitors and its applications, Capacitors in series and parallel. |
| 15 | Cleaning and topping up of a lead acid<br>battery, Testing battery with | Description of Chemical effects, Batteries & cells, Lead acid batteries & Stay Maintenance Free (SMF) batteries, Magnetic effects, Heating |

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| | hydrometer,<br>Connecting battery to a charger for battery charging, Inspecting & testing a battery after charging**,** Measure and Diagnose the cause(s) of excessive Key-off battery drain (parasitic draw) and do corrective action. Testing of relay and solenoids and its circuit. | effects, Thermo-electric energy, Thermisters, Thermo couples, Electrochemical energy, Photo-voltaic energy, Piezo-electric energy, Electromagnetic induction, Relays, Solenoids, Primary & Secondary windings, Transformers, stator and rotor coils. |
| 16 | Identify and test power and signal connectors for continuity, Identify and test different type of Diodes, NPN & PNP Transistors for its functionality**,**<br>Construct and test simple logic circuits OR, AND & NOT and Logic gates using switches. | **Basic electronics**: Description of Semi conductors, Solid state devices- Diodes, Transistors, Thyristors, Uni Junction Transistors ( UJT), Metal Oxide Field Effect Transistors ( MOSFETs), Logic gates-OR, AND & NOT and Logic gates using switches. |
| 17& 18 | Practice to make straight beads and Butt, Lap & T joints Manual Metal Arc Welding.<br>Setting of Gas welding flames, practice to make a straight beads and joints Oxy – Acetylene welding<br>Film on Heat treatment process | **Introduction to welding and Heat Treatment**<br>**Welding processes** – Principles of Arc welding, brief description, classification and applications. Manual Metal Arc welding -principles, power sources, electrodes, welding parameters, edge preparation & fit up and welding techniques; Oxy – Acetylene welding - principles, equipment, welding parameters, edge preparation & fit up and welding techniques;.<br>Heat Treatment Process– Introduction, Definition of heat treatment, Definition of Annealing, Normalizing, Hardening and tempering. Case hardening, Nitriding, Induction hardening and Flame Hardening process used in auto components with examples. |
| 19 & 20 | Practice on Liquid penetrant testing method and Magnetic particle testing method.<br>Identification of Hydraulic and pneumatic components used in vehicle.<br>Tracing of hydraulic circuit on hydraulic jack, hydraulic power steering, and Brake circuit. Identification of components in Air brake systems**.** | **Non-destructive Testing Methods- Importance of Non-Destructive Testing In Automotive Industry, Definition of NDT,** Liquid penetrant and Magnetic particle testing method – Portable Yoke method<br>**Introduction to Hydraulics & Pneumatics: -** Definition of Pascal law, pressure, Force, viscosity. Description, symbols and application in automobile of Gear pump-Internal & External, single acting, double acting & Double ended cylinder; Directional control valves-2/2, 3/2, 4/2, 4/3 way valve, Pressure relief valve, Non return valve, Flow control valve used in automobile. |

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| | | Pneumatic Symbols, Description and function of air Reciprocating Compressor. Function of Air service unit (FRL-Filter, Regulator & Lubricator). |
| 21 | Identification of different type of Vehicle.<br>Demonstration of vehicle specification data;<br>Identification of vehicle information Number (VIN). Demonstration of Garage, Service station equipments.- Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands. | Auto Industry - History, leading manufacturers, development in automobile industry, trends, new product. Brief about Ministry of Road transport & Highways,<br>The Automotive Research Association of India (ARAI), National Automotive Testing and R&D Infrastructure Project (NATRIP), & Automobile Association.<br><br>Definition: - Classification of vehicles on the basis of load as per central motor vehicle rule, wheels, final drive, and fuel used, axles, position of engine and steering transmission, body and load. Brief description and uses of Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands. |
| 22-23 | In-plant Training | |
| 24-25 | Revision and Test | |
| 26 | NCVT Exam | |

**Automobile Group – 1 year Trade**
**1st Semster**
**Workshop Calculation and Science**
**Syllabus for the trade of**
**1. Mechanic Diesel**

| Week No. | Workshop calculation and Science (3 Hrs/week) |
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| 1 | Units, Derived and fundamental, types of system FPS, CGS, MKS and their conversion. Metric weights and measurements, units conversion factors |
| 2 | Fractions- Addition and subtraction, Fractions and whole numbers, Combined addition and subtraction, Multiplication and division of fractions. Operations in problems involving fractions. |
| 3 | Order of performing (BODMAS) Mathematical operators , Integers – Rules for dealing with integers, Addition, subtraction, Multiplication and division. |
| 4 & 5 | Ratio and proportion. Percentages, Examples of ratios in Automotive technology |
| 6 | profit and loss, Discount . |
| 7 | simple interest and compound interest |
| 8 | depreciation calculation |
| 9-10 | Time and work problem , Time and distance, clocks and calendar, |
| 11 | Brief description of manufacturing process of steel, and aluminum |
| 12 | Meaning of elasticity, malleability, brittleness, hardness, compressibility & ductility and their examples , Properties and uses of cast iron, ferrous metal, gray cast iron, white cast iron, wrought iron, and plain carbon steel, high speed steel and alloy steel. |
| 13 | Properties and uses in automobile industries- copper, zinc, lead, tin, aluminum, brass, bronze, solder bearing metals, timber and rubber. Nylon, P.V.C., PP (poly prop line, polymer). |
| 14-15 | **Materials – Stress, strain,-** Definition of Stress, Types of stress- Tensile, compressive, shear , Examples of the three basic stresses in automotive components , calculation of stress and strain in automotive application, Stress raisers, Strain-, Tensile, compressive, Shear strain, Tensile strength, Factor of safety, Torsional stress, Strain energy. |
| 16 | Definition of cold working and Hot working and its properties on sheet metal. Advantage of Deep drawing material. Importance of Iron- carbon diagram in heat treatment process. |
| 17 | Different Type of cutting fluids and their properties. Calculation of cutting speed, feed and drilling time. |
| 18-19 | **Forces** – Definition of Force, Types of force -examples,– Direct forces, Attractive forces, Explosive forces, Describing forces, Graphical representation of a force, Addition of forces, Parallelogram of forces ,Triangle of forces, Resolution of forces, Mass, Equilibrium, Pressure, Pressure in hydraulic systems, Hooke's law, Practical applications. |
| 20-21 | **Work energy, power–** Definition and calculation of Work, Power and Work done by a torque, Definition and calculation of Energy -Potential energy, Chemical energy, Conservation of energy, Energy equation, Kinetic energy, Energy of a falling body, Kinetic energy of rotation. |

Automobile Group – 1 year Trade

**1st Semester Engineering Drawing**

**Syllabus for the trade of Mechanic Diesel**

| Week No. | **Engineering Drawing (3 Hrs/week)**<br>**1st Semester** |
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| 1 | Importance of engineering drawing as a communication medium, different types of drawing - Machine Drawing, Production Drawing, Part Drawing, Assembly Drawing, Drawing instruments, equipment and materials and their uses |
| 2&3 | Scales - Recommended scales, reduced & enlarged Drawing Sheet sizes: A0, A1, A2, A3, A4, A5, Layout of drawing sheet, sizes of title block and its contents. Using drawing instruments to draw straight lines, rectangles, squares, circles, polygons. |
| 4&5 | Lettering and Dimensioning - Types of Lettering, Guide Lines for lettering, Recommended sizes of letters and numbers, Single stroke letters, Dimensioning - rules and systems of dimensioning – dimensioning a given drawing. |
| 6&7 | Identify the alphabet of lines- Read and Interpret the meaning of various line types with examples- Object Lines, Hidden Lines, Center Lines, Phantom Lines, Dimension Lines, Extension Lines, Leaders, Break Lines -Long-break Line, Round, Solid, Hollow Cross Section, Section Lines – Common Manufacturing Materials, Cutting Plane Lines |
| 8-11 | Geometric Construction - Bisecting a line - perpendiculars - parallel lines - division of a line; Angles - bisection, trisection, Tangent lines touching circles internally and externally Polygons - Regular polygons - circumscribed and inscribed in circles. Conic sections - Definitions of focus, directrix, eccentricity, Construction of Ellipse by Concentric circles method, Construction of parabola by rectangular method. |
| 12&13 | Orthographic Projection - Definition - Planes of Projection - Four quadrants – Reference Line, First angle projection - Third angle projection. |
| 14-17 | Isometric Projection - Definition - Isometric axes, lines and planes, Isometric Scale - Isometric view. Drawing of isometric views of plane figures, Drawing of isometric views of prisms and pyramids, Drawing of isometric view of cylinders and cones |
| 18-21 | Development of Surfaces - Need for preparing development of surface, Concept of true length - Principal methods of development, Development of simple solids like cubes, prisms, cylinders, pyramids, cones. |

## SYLLABUS FOR EMPLOYABILITY SKILLS

## SEMESTER-I

(pl ref to www.dget.nic.in)

**Syllabus for the trade of Mechanic Diesel**
**Second Semester (Semester code No. )**
**Duration: Six Months.**

**Syllabus for Trade practical and Trade Theory**

| Week No. | Trade Practical (27 Hrs/week) | Trade Theory (5 Hrs/week) |
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| 1 & 2 | Identification of parts in a diesel engine of LMV/ HMV<br><br>Practice on starting and stopping of diesel engines.<br><br>Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition.<br><br>Practice on dismantling Diesel engine of LMV/HMV as per procedure. | **Introduction to Engine:**<br>Description of internal & external combustion engines, Classification of IC engines, Principle & working of 2&4-stroke diesel engine (Compression ignition Engine (C.I)**),** Principle of Spark Ignition Engine(SI), differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, Direct injection and Indirect injection, Technical terms used in engine, Engine specification. Study of various gauges/instrument on a dash board of a vehicle- Speedometer, Tachometer, Odometer and Fuel gauge, and Indicators such as gearshift position, Seat belt warning light, Parking-brake-engagement warning light and an Engine-malfunction light.<br>Different type of starting and stopping method of Diesel Engine<br>Procedure for dismantling of diesel engine from a vehicle.. |
| 3 & 4 | Overhauling of cylinder head assembly, Use of service manual for clearance and other parameters, Practice on removing rocker arm assembly manifolds.<br>Practice on removing the valves and its parts from the cylinder head, cleaning. Inspection of cylinder head and manifold surfaces for warping, cracks and flatness. Checking valve seats & valve guide – Replacing the valve if necessary. Testing leaks of valve seats for leakage – Dismantle rocker shaft assembly -clean & check rocker shaft-and levers, for wear and cracks and reassemble. Check valve springs, tappets, push rods, tappet screws and valve stem cap. Reassembling valve parts in sequence, refit cylinder head and manifold & rocker arm assembly, adjustable valve clearances, starting engine after adjustments. | **Diesel Engine Components:** Description and Constructional feature of Cylinder head, Importance of Cylinder head design, Type of Diesel combustion chambers, Effect on size of Intake & exhaust passages, Head gaskets. Importance of Turbulence<br>**Valves & Valve Trains-** Description and Function of Engine Valves, different types, materials, Type of valve operating mechanism, Importance of Valve seats**,** Valve seats inserts in cylinder heads**,** importance of Valve rotation**,** Valve stem oil seals**,** size of Intake valves**,** Valve trains**,** Valve- timing diagram**,** concept of Variable valve timing**.** Description of Camshafts & drives **,** Description of Overhead camshaft**,** importance of Cam lobes**,** Timing belts & chains**,** Timing belts & tensioners. |

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| 5 | Overhauling piston and connecting rod Assembly. Use of service manual for clearance and other parameters:-<br>Practice on removing oil sump and oil pump – clean the sump. Practice on removing the big end bearing, connecting rod with the piston. Practice on removing the piston rings; Dismantle the piston and connecting rod. Check the side clearance of piston rings in the piston groove & lands for wear. Check piston skirt and crown for damage and scuffing, clean oil holes.<br>Measure -the piston ring close gap in the cylinder, clearance between the piston and the liner, clearance between crank pin and the connecting rod big end bearing.<br><br>Check connecting rod for bend and twist. Assemble the piston and connecting rod assembly. | Description & functions of different types of **pistons**, piston rings and piston pins and materials. Used recommended clearances for the rings and its necessity precautions while fitting rings, common troubles and remedy. Compression ratio.<br><br>Description & function of **connecting rod,** importance of big- end split obliquely, Materials used for connecting rods big end & main bearings. Shells piston pins and locking methods of piston pins. |
| 6 | Overhauling of crankshaft, Use of service manual for clearance and other parameters:- Practice on removing damper pulley, timing gear/timing chain, flywheel, main bearing caps, bearing shells and crankshaft from engine checking oil retainer and thrust surfaces for wear, Measure crank shaft journal for wear, taper and ovality, Checking crankshaft for fillet radii, bend & twist. | Description and function of **Crank shaft**, camshaft, Engine bearings- classification and location – materials used & composition of bearing materials- Shell bearing and their advantages- special bearings material for diesel engine application bearing failure & its causes-care & maintenance. Crank-shaft balancing, Firing order of the engine. |
| 7 | Checking of flywheel and mounting flanges, spigot, bearing. Check vibration damper for defects, Practice on removing cam shaft from engine block, Check for bend & twist of camshaft. Inspection of cam lobe, camshaft journals and bearings and measure cam lobe lift. Fixing bearing inserts in cylinder block & cap check nip and spread clearance & oil holes & locating lugs fix crank shaft on block-torque bolts - check end play remove shaft - check seating, repeat similarly for connecting rod and Check seating and refit. | Description and function of the **fly wheel** and vibration damper. Crank case & oil pump, gears timing mark, Chain sprockets, chain tensioner etc. Function of clutch & coupling units attached to flywheel. |
| 8 | Cleaning and Checking of cylinder blocks Surface for any crack, flatness, Measure cylinder bore for taper & ovality, clean oil gallery passage and oil pipe line, Bore - descale water passages and examine Removing cylinder liners from scrap cylinder block, practice in measuring and | Description of **Cylinder block,** Cylinder block construction, and Different type of Cylinder sleeves (liner). |

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| | refitting new liners as per maker's recommendations precautions while fitting new liners. | |
| 9 | Reassemble all parts of engine in correct Sequence and torque all bolts and nuts as per workshop manual of the engine. Engine component procedures- Testing cylinder compression**,** Checking idle speed**,** Removing & replacing a cam belt**,** Inspecting & adjusting an engine drive belt**,** Replacing an engine drive belt. | **Engine assembly** procedure with aid of special tools and gauges used for engine assembling. Introduction to Gas Turbine, Comparison of single and two stage turbine engine, Different between gas turbine and Diesel Engine. |
| 10-12 | Practice on Checking &Top up coolant, Draining & refilling coolant, Checking / replacing a coolant hose, Testing cooling system pressure, Practice on Removing & replacing radiator/ thermostat. Inspect the radiator pressure cap, Testing of thermostat. Cleaning & reverse flushing. Overhauling water pump and refitting.<br>Practice on Checking engine oil**,** Draining engine oil**,** Replacing oil filter**,** Refilling engine oil**.** Overhauling of oil pump, oil coolers, air cleaners and air filters and adjust oil pressure relief valves, repairs to oil flow pipe lines and unions if necessary. | **Need for Cooling systems,** Heat transfer method, Boiling point & pressure, Centrifugal force, Vehicle coolant properties and recommended change of interval, Different type of cooling systems, **Basic cooling system components-** Radiator, Coolant hoses, Water pump, Cooling system thermostat, Cooling fans, Temperature indicators, Radiator pressure cap, Recovery system, Thermo-switch.<br><br>**Need for lubrication system**, Functions of oil, Viscosity and its grade as per SAE **,** Oil additives**,** Synthetic oils, The lubrication system**,** Splash system**,** Pressure system**,** Corrosion/noise reduction in the lubrication system. Lubrication system components - Description and function of Sump**,** Oil collection pan**,** Oil tank**,** Pickup tube**,** different type of Oil pump & Oil filters Oil pressure relief valve**,** Spurt holes & galleries**,** Oil indicators**,** Oil cooler. |
| 13. | Practice on Dismantling air compressor and exhauster and cleaning all parts - measuring wear in the cylinder, reassembling all parts and fitting them in the engine.<br><br>Dismantling & assembling of turbocharger, check for axial clearance as per service manual.<br><br>Check Exhaust system for rubber mounting for damage, deterioration and out of position; for leakage, loose connection, dent and damage;<br>Practice on Exhaust manifold removal and installation.<br>Practice on Catalytic converter removal and installation. | **Intake & exhaust systems** – Description of Diesel induction & Exhaust systems. Description & function of air compressor, exhauster, Super charger, Intercoolers, turbo charger, variable turbo charger mechanism.<br><br>**Intake system components-** Description and function of Air cleaners, Different type air cleaner, Description of Intake manifolds and material**,**<br><br>**Exhaust system components-** Description and function of Exhaust manifold**,** Exhaust pipe**,** Extractors**,** Mufflers- Reactive, absorptive, Combination.**,** |

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| | | Catalytic converters**,** Flexible connections**,** Ceramic coatings**,** Back-pressure, Electronic mufflers**.** |
| 14 - 16 | Practice on removing & Cleaning fuel tanks, checking leaks in the fuel lines, soldering & repairing pipe lines and Unions, brazing nipples to high pressure line studying the fuel feed system in diesel engines, draining of water separators.<br><br>Bleeding of air from the fuel lines, Servicing primary & secondary filters.<br><br>Removing a fuel injection pump from an engine-refit the pump to the engine re- set timing - fill lubricating-oil start and adjust slow speed of the engine.<br>Practice on overhauling of injectors and testing of injector.<br>General maintenance of Fuel Injection Pumps (FIP). | **Diesel Fuel Systems-** Description and function of Diesel fuel injection, fuel characteristics**,** concept of Quiet diesel technology **&** Clean diesel technology.<br>**Diesel fuel system components –** Description and function of Diesel tanks & lines**,** Diesel fuel filters**,** water separator, Lift pump**,** Plunger pump**,** Priming pump**,** Inline injection pump**,** Distributor-type injection pump**,** Diesel injectors**,** Glow plugs**,** Cummins & Detroit Diesel injection.<br>**Electronic Diesel control-** Electronic Diesel control systems**,** Common Rail Diesel Injection (CRDI) system**,** Hydraulically actuated electronically controlled unit injector (HEUI) diesel injection system. Sensors, actuators and ECU (Electronic Control Unit) used in Diesel Engines. |
| 17 | Practice on Start engine adjust idling speed and damping device in pneumatic governor and venture control unit checking Performance of engine with off load adjusting timings. Start engine- adjusting idle speed of the engine fitted with mechanical governor checking- high speed operation of the engine.<br>Checking performance for missing cylinder by isolating defective injectors and test- dismantle and replace defective parts and reassemble and refit back to the engine | **Marine & Stationary Engine**:- Types, double acting engines, opposed piston engines, starting systems, cooling systems, lubricating systems, supplying fuel oil, hydraulic coupling, reduction gear drive, electromagnetic coupling, electrical drive, generators and motors, supercharging. |
| 18 | Monitoring emissions procedures by use of Engine gas analyser or Diesel smoke meter. Checking & cleaning a Positive crank case ventilation (PCV) valve**.** Obtaining & interpreting scan tool data. Inspection of EVAP canister purge system by use of scan Tool.<br>EGR /SCR Valve Remove and installation for inspection. | **Emission Control:-** Vehicle emissions Standards- Euro and Bhart II, III, IV, V Sources of emission, Combustion**,** Combustion chamber design. **Types of emissions**: Characteristics and Effect of Hydrocarbons**,** Hydrocarbons in exhaust gases**,** Oxides of nitrogen**,** Particulates**,** Carbon monoxide**,** Carbon dioxide**,** Sulfur content in fuels Description of Evaporation emission control**,** Catalytic conversion**,** Closed loop**,** Crankcase emission control**,** Exhaust gas recirculation **(**EGR) valve**,** , Controlling air-fuel ratios**,** Charcoal storage devices, Diesel particulate filter (DPF). Selective Catalytic |

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|---|---|---|
| | | Reduction (SCR), EGR VS SCR |
| 19 | Practice on removing alternator from vehicle dismantling, cleaning checking for defects, assembling and testing for motoring action of alternator & fitting to vehicles.<br><br>Practice on removing starter motor Vehicle and overhauling the starter motor, testing of starter motor | Description .of **charging circuit** operation of alternators, regulator unit, ignition warning lamp- troubles and remedy in charging system.<br><br>Description of **starter motor circuit,** Constructional details of starter motor solenoid switches, common troubles and remedy in starter circuit. |
| 20 & 21 | Practice on troubleshooting in LMV/HMV for Engine Not starting – Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise. | **Troubleshooting :** Causes and remedy for Engine Not starting – Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise. |
| 22-23 | In-plant Training | |
| 24-25 | Revision and Test | |
| 26 | NCVT Exam | |

**Automobile Group – 1 year Trade**
**2nd Semster**
**Workshop Calculation and Science**
**Syllabus for the trade of**
**1. Mechanic Diesel**

| Week No. | Workshop calculation and Science (3 Hrs/week) |
|---|---|
| 1 & 2 | **Factorisation and quadratics**: multiply expressions in brackets by a number, symbol or by another expression in a bracket; by extraction of a common factor eg ax + ay, a(x + 2) + b(x + 2) ; by grouping eg ax − ay + bx − by ; quadratic expressions eg $a^2 + 2ab + b^2$ ; roots of an equation eg quadratic equations with real roots by factorisation, and by the use of formula |
| 3 | **Geometry–** Use of scientific calculator,/logarithmic table Angles -Angular measurement, Angles and rotation, Examples of angles in automotive work, Adding and subtracting angles. Types of angle- Adjacent angles, Opposite angles, Corresponding angles, Alternate angle |
| 4-6 | **Trigonometry-** Types of triangle - Acute angled triangle, Obtuse angled triangle, Equilateral triangle, Isosceles triangle, Scalene triangle, Right angled triangle, Labelling sides and angles of a triangle, Sum of the three angles of a triangle. Pythagoras' theorem, Circles, Ratio of diameter and circumference, Length of arc, Timing marks, Wheel revolutions and distance travelled, Valve opening area. Trigonometry- Using sines, cosines and tangents to solve vehicle problems. |
| 7 -10 | Formulae for Perimeter and Area of Plane figure - Rectangle, Square, Parallelogram, Triangle, Hexagon, any regular polygon, Trapezium, Circle, sector, Fillet, Ellipse, segment of a circle;<br>Formulae for Volume and surface area of solids- Rectangular solid, Prism, cylinder, pyramids and cones, Frustum of pyramid and cones, sphere, Hollow sphere, segment of sphere, circular ring, spherical sector,<br>Calculation of volume and weight of simple solid bodies such as cubes, square and hexagonal prism-shop problem. |
| 11-13 | Statistics – Collecting and sorting raw data, Definition of Discrete variable, continuous variable with Shop examples. Constructing pictographs-pie chart, Bar chart. Frequency and tally Charts. Importance of the shape of a frequency distribution- histogram, frequency polygon, Cumulative frequency plot. Interpreting statistics- sampling, arithmetic mean, median, |
| 14 & 15 | **Heat and temperature –**Temperature-Thermodynamic temperature scale (Kelvin), Cooling system temperature; Standard temperature and pressure (STP); Thermal expansion with calculation; Heat- Sensible heat, Latent heat, Specific latent heat, Specific heat capacity, Quantity of heat with calculation; Heat transfer – Conduction, Convection, Radiation ; |
| 16 & 17 | **Heating, expansion and compression of gases** - Absolute pressure, Absolute temperature; Laws relating to the compression and expansion of gases -Heating a gas at constant volume, Heating a gas at constant pressure, Charles' law. Expansion or compression at constant temperature – isothermal |

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|---|---|
| 18-20 | **Internal combustion engines-** Engine power-Brake power, Horsepower, PS – the DIN, Indicated power, Mean effective pressure, Calculation of indicated power, Cylinder pressure vs. crank angle, Mechanical efficiency of an engine, Volumetric efficiency, Torque vs. engine speed, Specific fuel consumption vs. engine speed, Brake power, torque and sfc( Specific fuel consumption) compared, Brake mean effective pressure, Thermal efficiency, Indicated thermal efficiency, Brake thermal efficiency petrol vs. Diesel. |
| 21 | **Fuels and combustion-** Calorific value, Combustion-Products of combustion, Relevant combustion equations. Air–fuel ratio-Petrol engine combustion, Detonation, Pre-ignition, Octane rating, Diesel fuel, Flash point , Pour point, Cloud point, Biofuels, Liquefied petroleum gas (LPG) ,Hydrogen, Zero emissions vehicles (ZEVs) |

Automobile Group –

**2nd Semester**

**Engineering Drawing**

**Syllabus for the trade of Mechanic Diesel**

| Week Nos. | **Engineering Drawing (3 Hrs/week)**<br>**2nd Semester** |
|---|---|
| 1-4 | Read and interpret drawings- Determine information from the title block, Read and interpret industrial prints, Read and interpret detailed and assembly drawings, Identify casting drawings and machining drawings, Read and interpret diagrams, Distinguish between a monodetail and a multidetail drawing. |
| 5-8 | Identify different drawing projections - Interpret pictorial and multi-view drawings. Interpret auxiliary and section views, Determine views in a drawing and the significance of the view being shown. Identify missing lines and missing views. |
| 9-12 | Free hand sketching of key and screw threads. Read and interpret three Types of screw thread representation: pictorial, schematic and simplified presentation. Terms used in describing a threaded Part , Designation of Thread Specifications, Left-Hand Thread Notations, read and interpret the different type of Finish Symbols, Fillets and Rounds and Machine Slots. |
| 13 | Drawing of I .C engine – Diesel and their parts. |
| 14 | Sketching of otto cycle, Diesel cycle, valves and valve timing diagram. |
| 15 | Free hand sketch of piston assembly, Free hand sketching of piston gudgeon pins rings and connecting rod . |
| 16 | Free hand sketching of crank shaft and cam shaft showing all parts. |
| 17 | Free hand sketching of cylinder block and cylinder head, cylinder liners . |
| 18 | Free hand sketching of different cooling system -showing all necessary parts such as water pump, thermostatic valve, Radiator etc. |
| 19 | Free hand sketching of lubrication system, showing all necessary parts such as filters , oil pump, pressure release valve etc. |
| 20 | Freehand sketching of staring system. |
| 21 | Freehand sketching of charging system and solenoid switch circuit. |

# SYLLABUS FOR EMPLOYABILITY SKILLS

SEMESTER-II
(Pl ref to www.dget.nic.in)

## TRADE: Mechanic Diesel

### LIST OF TOOLS & EQUIPMNT

### A. TRAINEES TOOL KIT per 4 Trainees FOR 20 TRAINEES +1 ISTRUCTOR

| Sl.No. | Item with specification | Qty (Nos.) |
|---|---|---|
| 1. | Allen Key set of 12 pieces (2mm to 14mm) | (5+1) |
| 2. | Caliper inside 15 cm Spring | 6 |
| 3. | Calipers outside 15 cm spring | 6 |
| 4. | Center Punch 10 mm. Dia. x 100 mm. | 6 |
| 5. | Dividers 15 cm Spring | 6 |
| 6. | Electrician Screw Driver 250mm | 6 |
| 7. | Hammer ball peen 0.5 kg with handle | 6 |
| 8. | Hands file 20 cm. Second cut flat | 6 |
| 9. | Philips Screw Driver set of 5 pieces (100 mm to 300 mm) | 6 |
| 10. | Pliers combination 20 cm. | 6 |
| 11. | Screw driver 20cm.X 9mm. Blade | 6 |
| 12. | Screw driver 30 cm. X 9 mm. Blade | 6 |
| 13. | Scriber 15 cm | 6 |
| 14. | Spanner D.E. set of 12 pieces (6mm to 32mm) | 6 |
| 15. | Spanner, ring set of 12 metric sizes 6 to 32 mm. | 6 |
| 16. | Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box | 6 |
| 17. | Steel rule 30 cm inch and metric | 6 |
| 18. | Steel tool box with lock and key (folding type) 400x200x150 mm | 6 |
| 19. | Wire cutter and stripper | 6 |

### B. Tools Instruments and General Shop outfits

| Sl.No. | Item with specification | Qty. (Nos) |
|---|---|---|
| 1. | Adjustable spanner (pipe wrench 350 mm) | 2 |
| 2. | Air blow gun with standard accessories | 1 |
| 3. | Air impact wrench with standard accessories | 4 |
| 4. | Air ratchet with standard accessories | 4 |
| 5. | Allen Key set of 12 pieces (2mm to 14mm) | 4 |
| 6. | Ammeter 300A/ 60A DC with external shunt | 4 |
| 7. | Angle plate adjustable 250x150x175 | 1 |
| 8. | Angle plate size 200x100x200mm | 2 |
| 9. | Anvil 50 Kgs with Stand | 1 |
| 10. | Auto Electrical test bench | 1 |
| 11. | Battery –charger | 2 |
| 12. | Belt Tensioner gauge | 1 |
| 13. | Blow Lamp 1 litre | 2 |
| 14. | Caliper inside 15 cm Spring | 4 |
| 15. | Calipers outside 15 cm spring | 4 |
| 16. | Car Jet washer with standard accessories | 1 |
| 17. | Chain Pulley Block-3 ton capacity with tripod stand | 1 |

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|---|---|---|
| 18. | Chisel 10 cm flat | 4 |
| 19. | Chisels cross cut 200 mm X 6mm | 4 |
| 20. | Circlip pliers Expanding and contracting type 15cm and 20cm each | 4 |
| 21. | Clamps C 100mm | 2 |
| 22. | Clamps C 150mm | 2 |
| 23. | Clamps C 200mm | 2 |
| 24. | Cleaning tray 45x30 cm. | 4 |
| 25. | Compression testing gauge suitable for diesel Engine with standard accessories | 2 |
| 26. | Connecting rod alignment fixture | 1 |
| 27. | Copper bit soldering iron 0.25 Kg | 4 |
| 28. | Cylinder bore gauge capacity 20 to 160 mm | 4 |
| 29. | Cylinder liner- Dry & wet liner, press fit & slidefit liner | 1 each |
| 30. | DC Ohmmeter 0 to 300 Ohms, mid scales at 20 Ohms | 2 |
| 31. | Depth micrometer 0-25mm | 4 |
| 32. | Dial gauge type 1 Gr. A (complete with clamping devices and with magnetic stand) | 4 |
| 33. | Different type of Engine Bearing model | 1 set |
| 34. | Different type of piston model | 1each |
| 35. | Dividers 15 cm Spring | 4 |
| 36. | Drift Punch Copper 15 Cm | 4 |
| 37. | Drill point angle gauge | 1 |
| 38. | Drill twist 1.5 mm to 15 mm (various sizes) by 0.5 mm | 4 |
| 39. | Electric Soldering Iron 230 V 60 watts 230 V 25 watts | 2 each |
| 40. | Electric testing screw driver | 4 |
| 41. | Engineer's square 15 cm. Blade | 4 |
| 42. | Engineers stethoscope | 1 |
| 43. | Feeler gauge 20 blades (metric) | 4 |
| 44. | File flat 20 cm bastard | 4 |
| 45. | File, half round 20 cm second cut | 4 |
| 46. | File, Square 20 cm second cut | 4 |
| 47. | File, Square 30 cm round | 4 |
| 48. | File, triangular 15 cm second cut | 4 |
| 49. | Files assorted sizes and types including safe edge file (20 Nos) | 2 set |
| 50. | Flat File 25 cm second cut | 4 |
| 51. | Flat File 35 cm bastard | 4 |
| 52. | Fuel feed pump for Diesel | 1 |
| 53. | Fuel injection pump (Diesel) inline | 1 |
| 54. | Fuel injection pump dismantling tool kit /Universal Vice | 1 |
| 55. | Fuel injection pump VE pump / Distributor fuel rotary pump (DPC) pumps / along with special tools and accessories. | 1 each |
| 56. | Gloves for Welding (Leather and Asbestos) | 5 sets |
| 57. | Glow plug tester | 2 |
| 58. | Granite surface plate 1600 x 1000 with stand and cover | 1 |
| 59. | Grease Gun | 2 |
| 60. | Grease Gun heavy duty trolley type 10 kg capciaty | 1 |
| 61. | Growler | 2 |
| 62. | Hacksaw frame adjustable 20-30 cm | 10 |
| 63. | Hammer Ball Peen 0.75 Kg | 4 |

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|---|---|---|
| 64. | Hammer Chipping 0.25 Kg | 5 |
| 65. | Hammer copper 1 Kg with handle | 4 |
| 66. | Hammer Mallet | 4 |
| 67. | Hammer Plastic | 4 |
| 68. | Hand operated crimping tool (i) for crimping up to 4mm and (ii) for crimping up to 10mm | 2 |
| 69. | Hand reamers adjustable 10.5 to 11.25 mm, 11.25 to 12.75 mm, 12.75 to 14.25 mm and 14.25 to 15.75 mm | 2sets |
| 70. | Hand Shear Universal 250mm | 2 |
| 71. | Hand vice – 37 mm | 2 |
| 72. | Hollow Punch set of seven pieces 6mm to 15mm | 2 sets each |
| 73. | Injector – Multi hole type, Pintle type | 4 each |
| 74. | Injector cleaning unit | 1 |
| 75. | Injector testing set (Hand tester) | 1 |
| 76. | Insulated Screw driver 20 cm x 9mm blade | 4 |
| 77. | Insulated Screw driver 30 cm x 9mm blade | 4 |
| 78. | Left cut snips 250mm | 4 |
| 79. | Lifting jack screw type 3 ton, 5ton & 20 Ton capacity | 1 each |
| 80. | Magneto spanner set with 8 spanners | 1 set |
| 81. | Magnifying glass 75mm | 2 |
| 82. | Marking out table 90X60X90 cm. | 1 |
| 83. | Multimeter digital | 5 |
| 84. | Oil can 0.5/0.25 liter capacity | 4 |
| 85. | Oil pump for dismantling and assembling. | 2 |
| 86. | Oil Stone 15 cm x 5 cm x 2.5 cm | 1 |
| 87. | Oscilloscope 20MHz | 2 |
| 88. | Outside micrometer 0 to 25 mm | 4 |
| 89. | Outside micrometer 25 to 50 mm | 4 |
| 90. | Outside micrometer 50 to 75 mm | 1 |
| 91. | Outside micrometer 75 to 100 mm | 1 |
| 92. | Philips Screw Driver set of 5 pieces (100 mm to 300 mm) | 2 |
| 93. | Pipe cutting tool | 2 |
| 94. | Pipe flaring tool | 2 |
| 95. | Piston ring compressor | 2 |
| 96. | Piston Ring expander and remover. | 2 |
| 97. | Piston Ring groove cleaner. | 1 |
| 98. | Pliers combination 20 cm. | 2 |
| 99. | Pliers flat nose 15 cm | 2 |
| 100. | Pliers round nose 15 cm | 2 |
| 101. | Pliers side cutting 15 cm | 2 |
| 102. | Portable electric drill Machine | 1 |
| 103. | Prick Punch 15 cm | 4 |
| 104. | Punch Letter 4mm (Number) | 2 set |
| 105. | Radiator cut section-cross flow | 1 |
| 106. | Radiator cut section-down flow | 1 |
| 107. | Radiator pressure cap | 2 |
| 108. | Right cut snips 250mm | 2 |
| 109. | Rivet sets snap and Dolly combined 3mm, 4mm, 6mm | 2 |

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|---|---|---|
| 110. | Scraper flat 25 cm | 2 |
| 111. | Scraper half round 25 cm | 2 |
| 112. | Scraper Triangular 25 cm | 2 |
| 113. | Scriber 15 cm | 2 |
| 114. | Scriber with scribing black universal | 2 |
| 115. | Set of stock and dies -Metric | 2 sets |
| 116. | Shear Tin Man's 450 mm x 600mm | 2 |
| 117. | Sheet Metal Gauge | 2 |
| 118. | Sher Tinmans 300mm | 4 |
| 119. | Soldering Copper Hatchet type 500gms | 2 |
| 120. | Solid Parallels in pairs (Different size) in Metric | 2 |
| 121. | Spanner Clyburn 15 cm | 1 |
| 122. | Spanner D.E. set of 12 pieces (6mm to 32mm) | 4 |
| 123. | Spanner T. flocks for screwing up and up-screwing inaccessible | 2 |
| 124. | Spanner, adjustable 15cm. | 2 |
| 125. | Spanner, ring set of 12 metric sizes 6 to 32 mm. | 4 |
| 126. | Spanners socket with speed handle, T-bar, ratchet and universal upto | 2 |
| 127. | Spark lighter | 2 |
| 128. | Spark plug spanner 14mm x 18mm x Size | 2 |
| 129. | Starter motor axial type, pre-engagement type & Co-axial type | 1each |
| 130. | Steel measuring tape 10 meter in a case | 4 |
| 131. | Steel rule 15 cm inch and metric | 4 |
| 132. | Steel rule 30 cm inch and metric | 4 |
| 133. | Straight edge gauge 2 ft. | 2 |
| 134. | Straight edge gauge 4 ft. | 2 |
| 135. | Stud extractor set of 3 | 2 sets |
| 136. | Stud remover with socket handle | 1 |
| 137. | Surface gauge with dial test indicator plunger type i.e. 0.01 mm | 4 |
| 138. | Tachometer (Counting type) | 1 |
| 139. | Tandem master cylinder with booster | 4 |
| 140. | Taps and Dies complete sets (5 types) | 1 set |
| 141. | Taps and wrenches - Metric | 2 sets |
| 142. | Telescope gauge | 4 |
| 143. | Temperature gauge with sensor 0-100 deg c | 2 |
| 144. | Thermostat | 2 |
| 145. | Thread pitch gauge Metric, | 2 |
| 146. | Timing lighter | 2 |
| 147. | Torque wrenches 5-35 Nm, 12-68 Nm & 50-225 Nm | 1 each |
| 148. | Trammel 30 cm | 2 |
| 149 | Turbocharger cut sectional view | 1 |
| 150 | Tyre pressure gauge with holding nipple | 2 |
| 151 | Universal puller for removing pulleys, bearings | 1 |
| 152 | V' Block 75 x 38 mm pair with Clamps | 2 |
| 153 | Vacuum gauge to read 0 to 760 mm of Hg. | 2 |
| 154 | Valve Lifter | 1 |
| 155 | Valve spring compressor universal. | 1 |
| 156 | vernier caliper 0-300 mm with least count 0.02mm | 4 |
| 157 | Vice grip pliers | 2 |
| 158 | Water pump for dismantling and assembling | 4 |

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|---|---|---|
| 159 | Wire Gauge (metric) | 2 |
| 160 | Work bench 250 x 120 x 60 cm with 4 vices 12cm Jaw | 4 |

## C. General Installation/ Machineries

| Sl.No. | Item with specification | Qty (Nos.) |
|---|---|---|
| 1. | Air conditioned CRDI Vehicle in running condition -LMV | 1 |
| 2. | Arbor press hand operated 2 ton capacity | 1 |
| 3. | Automotive exhaust 5 gas analyzer (petrol & Diesel) or Diesel Smoke meter | 1 |
| 4. | Bench lever shears 250mm Blade x 3mm Capacity | 1 |
| 5. | Diesel Engine – CRDI - 4 stroke for Dismantling and assembling with swivelling stand | 1 |
| 6. | Diesel engine ( Running condition ) Stationary type | 1 |
| 7. | Discrete Component Trainer / Basic Electronics Trainer | 1 |
| 8. | Drilling machine bench to drill up to 12mm dia along with accessories | 1 |
| 9. | Dual Magnetization Yoke : AC / HWDC, 230 VAC, 50Hz | 1 set |
| 10. | Gas Welding Table 1220mm x760mm | 2 |
| 11. | Grinding machine (general purpose) D.E. pedestal with 300 mm dia wheels rough and smooth | 1 |
| 12. | Heavy Commercial vehicle type (without body on frame) | 1 |
| 14. | Hydraulic jack HI-LIFT type -3 ton capacity, and 5 Ton capacity | 1 each |
| 15. | Liquid penetrant Inspection kit | 1 set |
| 16. | Multi Scan Tool with oscilloscope | 1 |
| 17. | Pipe Bending Machine (Hydraulic type) 12mm to 30mm | 1 |
| 18. | Pneumatic rivet gun with standard accessories | 2 |
| 19. | Spring tension tester | 1 |
| 20. | Tin smiths bench folder 600 x 1.6mm | 1 |
| 21. | Trolley type portable air compressor single cylinder with 45 liters capacity Air tank, along with accessories & with working pressure 6.5 kg/sq cm | 1 |
| 22. | Welding plant Oxy-Acetylene complete ( high pressure) | 1 |
| 23. | Welding Transformer ( 150-300 Amps) | 1 |
| 24. | Working Condition of Diesel Engine – CRDI - 4 stroke Engine Assembly with fault simulation board | |

## D. List of consumable:

| Sl. No. | Description | Quantity |
|---|---|---|
| 1. | Battery- SMF | As required |
| 2. | Brake fluids | As required |
| 3. | Chalk, Prussian blue. | As required |

| | | |
|---|---|---|
| 4. | Chemical compound for fasteners | As required |
| 5. | Diesel | As required |
| 6. | Different type gasket material | As required |
| 7. | Different type of oil seal | As required |
| 8. | Drill Twist (assorted) | As required |
| 9. | Emery paper - 36–60 grit , 80–120 | As required |
| 10. | Engine oil & Engine coolant | As required |
| 11. | Gear oils | As required |
| 12. | Gloves for Welding (Leather and Asbestos) | 5 sets |
| 13. | Hacksaw blade (consumable) | As required |
| 14. | Hand rubber gloves tested for 5000 V | 5 pair |
| 15. | Holders, lamp teakwood boards, plug sockets, | As required |
| 16. | Hydrometer | 8 |
| 17. | Lapping abrasives | As required |
| 18. | Leather Apron | 5 |
| 19. | Petrol | As required |
| 20. | Power steering oil | As required |
| 21. | Radiator Coolants | As required |
| 22. | Safety glasses | As required |
| 23. | Steel wire Brush 50mmx150mm | 5 |

### E. Workshop Furniture

| Sl. No. | Description | Quantity |
|---|---|---|
| 1. | Book shelf (glass panel) 6½ ‘ x 3’ x 1½’ | As required |
| 2. | Computer Chair | 1+1 |
| 3. | Computer Table | 1+1 |
| 4. | Desktop computer and related MS office software | 1+1 |
| 5. | Discussion Table 8’ x 4’ x 2½ ‘ | 2 |
| 6. | Fire Extinguishers, first- aid box | As required |
| 7. | Instructional Material – NIMI Books/Ref.books | As required |
| 8. | Internet connection with all accessories | As required |
| 9. | Laser printer | 1 |
| 10. | LCD projector/ LED /LCD TV (42”) | 1 |
| 11. | Multimedia DVD for Automotive application/subjects | As required |
| 12. | Online UPS 2KVA | 1 |
| 13. | Stools | 21 |
| 14. | Storage Rack 6½ ‘ x 3’ x 1½’ | As required |
| 15. | Storage shelf 6½ ‘ x 3’ x 1½’ | As required. |
| 16. | Suitable class room furniture | As required |
| 17. | Suitable Work Tables with vices | As required |
| 18. | Tool Cabinet - 6½ ‘ x 3’ x 1½’ | 2 |
| 19. | Trainees locker 6½ ‘ x 3’ x 1½’ | 2 Nos. to accommodate 20 Lockers |

**List of tools & Equipment for the Trade of**
**Mechanic Diesel - Engineering Drawing**
**(Note : Facilities available in Draughtsman trade can be utilized)**

**TRAINEE'S TOOLS KIT**

| Sl. No. | Name of the items | Quantity |
|---|---|---|
| 1. | Draughtsman drawing instrument box | 20+1 set |
| 2. | Set square celluloid $45^0$ (250 X 1.5 mm) | 20+1 set |
| 3. | Set square celluloid $30^0$-$60^0$ (250 X 1.5 mm) | 20+1 set |
| 4. | Mini drafter | 20+1 set |
| 5. | Drawing board (700mm x500 mm) IS: 1444 | 20+1 set |

## GENERAL MACHINERY SHOP OUTFIT

| Sl. No. | Name & Description of Machine | Quantity |
|---|---|---|
| 1. | Draughtsman table | 20 Nos. |
| 2. | Draughtsman stool | 20Nos. |